1. A flexural plate wave sensor comprising:

a flexural plate having a length and a width; and

a comb pattern over the flexural plate with drive teeth disposed across the entire length of the flexural plate to reduce the number of eigenmodes excited in the plate and thereby simplifying the operation and design of the flexure plate wave sensor.

2. The flexure plate wave sensor of claim 1 further including sense teeth disposed across the entire length of the flexure plate interleaved with the drive teeth.

3. The flexure plate wave sensor of claim 2 in which the sense teeth face in one direction and the drive teeth face in an opposite direction.

4. The flexure plate wave sensor of claim 1 wherein the comb pattern is aligned with all the eigenmodes of the flexural plate thereby exciting one eigenmode in the plate.

5. The flexure plate wave sensor of claim 1 wherein the comb pattern allows the sensor to output a single pronounced peak thereby improving the performance of the sensor.

6. The flexure plate wave sensor of claim 1 in which the comb pattern reduces a transfer function of the sensor to a single peak, or a peak much larger than any other peak.

7. The flexure plate wave sensor of claim 1 in which the drive teeth are aligned with the eigenmodes excited in the flexural plate.

8. The flexure plate wave sensor of claim 2 in which the sense teeth are aligned with the eigenmodes excited in the flexural plate.

9. The flexure plate wave sensor of claim 1 in which the comb pattern provides for establishing electric fields which interact with piezoelectric properties of the flexural plate to excite motion.

10. The flexure plate wave sensor of claim 1 in which the comb pattern is made of copper.

11. The flexure plate wave sensor of claim 1 in which the comb pattern is made of a material chosen from the group consisting of copper, titanium-platinum-gold (TiPtAu) metal, titanium-platinum (TiPt) and aluminum.

12. The flexure plate wave sensor of claim 1 in which the comb pattern is made of aluminum.

13. The flexure plate wave sensor of claim 1 in which the comb pattern is approximately 0.1 μm thick.

14. The flexure plate wave sensor of claim 1 in which the comb pattern includes wire bond pad areas and ground contacts.

15. The flexure plate wave sensor of claim 1 in which the drive teeth are on the flexural plate.

16. The flexure plate wave sensor of claim 2 in which the sense teeth are on the flexural plate.

17. The flexure plate wave sensor of claim 1 in which the drive teeth span across an entirety of the width of the flexural plate.

18. The flexure plate wave sensor of claim 2 in which the sense teeth span across an entirety of the width of the flexural plate.

19. The flexure plate wave sensor of claim 1 further including a base substrate, an etch stop layer disposed over said base substrate, a membrane layer disposed over said etch stop layer, a cavity disposed in said base substrate and said etch stop layer, thereby exposing a portion of said membrane layer, said cavity having substantially parallel interior walls, a piezoelectric layer disposed over said membrane layer and said

comb pattern disposed over said piezoelectric layer.

20. The flexure plate wave sensor of claim 19 wherein said piezoelectric layer is formed from a material selected from the group consisting of aluminum nitrite, zinc oxide and lead zirconium titanate.

21. The flexure plate wave sensor of claim 19 wherein said etch stop layer is formed from silicon dioxide.

22. The flexure plate wave sensor of claim 19 wherein said membrane layer is formed from silicon.

23. The flexure plate wave sensor of claim 19 wherein said base substrate is formed from silicon.

24. The flexure plate wave sensor of claim 23 wherein base substrate includes a silicon-on-insolator (SOI) wafer.

25. The flexure plate wave sensor of claim 24 in which the silicon-on-insulator wafer includes an upper surface of epitaxial silicon forming the membrane layer bonded to an etch stop layer.

26. The flexure plate wave sensor of claim 25 wherein the piezoelectric

transducer is deposited over the upper surface of the epitaxial silicon.

27. The flexure plate wave sensor of claim 25 wherein grounding contacts to the epitaxial silicon are provided by etching an opening into the piezoelectric transducer.

28. The flexure plate wave sensor of claim 27 wherein the comb pattern comprises titanium-platinum-gold (TiPtAu) metal, said comb pattern including interdigital metal electrodes, wire bond pad areas, and ground contacts.

29. The flexure plate wave sensor of claim 24 wherein said base substrate is approximately 380 μm thick.

30. The flexure plate wave sensor of claim 25 wherein said upper epitaxial surface is approximately 2 μm thick.

31. The flexure plate wave sensor of claim 25 wherein said layer of SiO_2 is approximately 1 μm thick.

32. The flexure plate wave sensor of claim 28 wherein said comb pattern is approximately 0.1 μm thick.

33. The flexure plate wave sensor of claim 1 wherein the drive teeth are approximately 300 to 2000 μm in length and the spacing between the drive teeth is

approximately 25 to 50 μm.

34. The flexure plate wave sensor of claim 1 wherein the sense teeth are approximately 300 to 2000 μm in length and the spacing between the sense teeth is approximately 25 to 50 μm.

35. A flexural plate wave sensor comprising:

a flexural plate having a length and a width; and

a comb pattern over the flexural plate with drive and sense teeth disposed across the entire length of the flexural plate to reduce the number of eigenmodes excited in the plate and thereby simplifying the operation and design of the flexure plate wave sensor.

36. A flexural plate wave sensor comprising:

a flexural plate having a length and a width; and

a comb pattern over the flexural plate with first and second sets of drive teeth disposed across the entire length of the flexural plate to reduce the number of eigenmodes excited in the plate and thereby simplify the operation and design of the flexural plate wave sensor.

37. The flexural plate wave sensor of claim 36 further including first and second sets of sense teeth disposed across the entire length of the flexural plate.

38. The flexural plate wave sensor of claim 36 in which the first and second sets of drive teeth face in opposite directions.

39. The flexural plate wave sensor of claim 36 in which the first and second sets of sense teeth face in opposite directions.

40. The flexural plate wave sensor of claim 38 in which the first and second sets of drive teeth are interleaved.

41. The flexural plate wave sensor of claim 39 in which the first and second sets of sense teeth are interleaved.

42. The flexural plate wave sensor of claim 40 in which the first and second

sets of interleaved drive teeth span approximately fifty percent of the width of the flexural plate.

43. The flexural plate wave sensor of claim 41 in which the first and second sets of interleaved sense teeth span approximately fifty percent of the width of the flexural plate.

44. The flexural plate wave sensor of claim 36 in which the first and second sets of drive teeth face in the same direction.

45. The flexural plate wave sensor of claim 37 in which the first and second sets of sense teeth face in the same direction.

46. The flexural plate wave sensor of claim 45 in which the first set of drive teeth is interleaved with the first set of sense teeth.

47. The flexural plate wave sensor of claim 46 in which the first set of drive teeth interleaved with the second set of sense teeth together span approximately fifty percent of the width of the flexural plate.

48. The flexural plate wave sensor of claim 45 in which the second set of drive teeth is interleaved with the second set of sense teeth.

49. The flexural plate wave sensor of claim 48 in which the second set of drive teeth interleaved with the first set of sense teeth together span approximately fifty percent of the width of the flexural wave plate.

DR-312J
RJC/mgt

50. A flexural wave plate sensor comprising:

a flexural plate having a length and a width; and

a comb pattern over the flexural plate with first and second sets of drive teeth disposed over the flexural plate, the first set of drive teeth spanning approximately seventy-five percent of the length of the flexural plate and the second set of drive teeth spanning approximately twenty-five percent of the length of the flexural plate, the comb pattern for reducing the number of eigenmodes excited in the plate and thereby simplifying the operation and design of the flexural plate wave sensor.

51. The flexural plate wave sensor of claim 50 further including first and second sets of sense teeth disposed over the flexural plate, the first set of sense teeth spanning approximately seventy-five percent of the length of the flexural plate and the second set of sense teeth spanning approximately twenty-five percent of the length of the flexural plate, the first and second sets of sense teeth interleaved with the first and second sets of drive teeth.

52. The flexural plate wave sensor of claim 50 in which the first and second sets of drive teeth face one direction and the first and second sense teeth face in an opposite direction.

53. A flexural plate wave sensor comprising:

a flexural plate having a length, width, and a center; and

a comb pattern over the flexural plate with first and second sets of drive teeth disposed across approximately fifty percent of the length of the flexural plate, each said set of drive teeth spanning approximately an entirety of the width of the flexural plate at one end and curving toward the center of the flexural plate at approximately the center of the plate, the comb pattern for reducing the number of eigenmodes excited in the plate and thereby simplifying the operation and design of the flexural plate wave sensor.

54. The flexural plate wave sensor of claim 53 further including first and second sets of sense teeth disposed across approximately fifty percent of the length of the flexural plate, each said set of sense teeth spanning approximately an entirety of the width of the flexural plate at one end and curving toward the center of the flexural plate at approximately the center of the plate.

55. A flexural wave plate sensor comprising:

a flexural plate having a length and a width; and

a comb pattern over the flexural plate, the comb pattern including drive teeth and sense teeth, the drive teeth and the sense teeth disposed over the flexural plate, the drive teeth spanning approximately fifty percent of the length of the flexural plate, the sense teeth spanning approximately fifty percent of the length of the flexural plate, the comb pattern for reducing the number of eigenmodes excited in the plate and thereby simplifying the operation and design of the flexural plate wave sensor.

56. A flexural wave plate sensor comprising:

a flexural plate having a length and a width; and

a comb pattern over the flexural plate, the comb pattern including a set of drive teeth and a set of sense teeth, the set of drive teeth and the set of sense teeth disposed over the flexural plate, the set of drive teeth spanning approximately fifty percent of the length of the flexural plate, the set of sense teeth spanning approximately fifty percent of the length of the flexural plate, the comb pattern for reducing the number of eigenmodes excited in the plate and thereby simplifying the operation and design of the flexural plate wave sensor.

57. A method for manufacturing a flexural plate wave sensor, the method comprising the steps of:

depositing an etch-stop layer over a substrate;

depositing a membrane layer over said etch stop layer;

depositing a piezoelectric layer over said membrane layer;

forming a comb pattern with drive teeth which span across an entire length of the piezoelectric layer on said piezoelectric layer;

etching a cavity through the substrate, the cavity having substantially parallel interior walls; and

removing a portion of the etch stop layer between the cavity and the membrane layer to expose a portion of the membrane layer.

58. The method of claim 57 further comprising the steps of etching a hole in the piezoelectric and forming a ground contact on the silicon membrane layer.

59. A method for manufacturing a flexural plate wave sensor, the method comprising the steps of:

depositing an etch-stop layer over a substrate;

depositing a membrane layer over said etch stop layer;

depositing a piezoelectric layer over said membrane layer;

forming a comb pattern on said piezoelectric layer, said comb pattern including drive and sense teeth which span an entire length of the membrane layer;

forming a second transducer on said piezoelectric layer, spaced from said first transducer;

etching a cavity through the substrate, the cavity having substantially parallel interior walls;

removing the portion of the etch stop layer between the cavity and the membrane layer to expose a portion of the membrane layer; and

depositing an absorptive coating on the exposed portion of the membrane layer.

60. The method of claim 59 further comprising the steps of etching a hole in the piezoelectric and forming a ground contact on the silicon membrane layer.